NASA TECH BRIEF

Marshall Space Flight Center

Materials Data Handbooks on Aluminum Alloys

For most applications, aluminum is alloyed with other metals to improve its structural strength. Its alloys, like those of other commercial metals, are divided into two broad classes: wrought alloys and casting alloys. Of the two, wrought alloys, by far, form the largest group. The wrought alloy products include sheet, plate, foil, tubing, rods, bars, wire, structural and special shapes, rivets, forgings, and screw-machine products.

To serve the needs of NASA designers, five handbooks have been prepared which describe the up-to-date properties of the following wrought-aluminum alloys: 2014, 2219, 5456, 6061, and 7075. Briefly, the properties of each are as follows:

Aluminum alloy 2014 is a heat-treatable wrought alloy, which was developed in 1928 as a high-strength alloy having good ductility and machinability for aircraft and other heavy-duty structural uses. The base alloy is similar to the commonly used 2024 (developed in 1931), in that copper is the primary alloying addition. Early in its history, 2014 was used mainly in the form of forging and extrusion products; at this time, the alloy is available in various products including sheet and plate.

Alloy 2219 also is a heat-treatable wrought alloy, which was developed in 1954 for applications at temperatures up to 600° F (315° C). Typical mechanical properties of 2219 in the temperature range of 500° to 600° F (260° to 315° C) are superior to those of any other commercially available aluminum alloy.

Alloy 5456 is a non-heat-treatable wrought alloy, first made available in 1956. This alloy is one of the aluminum-magnesium group of alloys containing small additions of other elements. The alloy has good corrosion resistance, moderately high strength, and excellent welding qualities without the necessity for post-weld treatment. It does not exhibit a ductile-to-brittle transition behavior when temperatures are lowered below room temperature.

Alloy 6061 is another heat-treatable wrought alloy, which was developed in 1935 as a general-purpose structural alloy. The main alloying elements are magnesium and silicon; the alloy also contains small additions of copper, chromium, iron, zinc, manganese, and titanium. This alloy is the most versatile of the wrought heat-treatable alloys.

Alloy 7075 is a high-strength heat-treatable wrought alloy, which was developed in 1943. This alloy contains zinc, magnesium, chromium, and copper, as hardeners, plus small additions of other elements. Aluminum 7075 responds to an age-hardening heat treatment that produces exceptionally high mechanical properties; it does, however, exhibit some degree of notch sensitivity.

Each handbook is divided into twelve chapters. The scope of the information presented includes physical- and mechanical-property data at cryogenic, ambient, and elevated temperatures, supplemented with useful information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented, as available, complemented with information on the typical behavior of the alloy.

Throughout each text, table, and figure, common engineering units (with which measurements were made) are accompanied by conversions to International (SI) Units, except in the instances where double units would overcomplicate data presentation or where SI units are impractical (e.g., machine tools and machining). In these instances, conversion factors are noted.

(continued overleaf)

Note:

Requests for specific handbooks may be directed to:

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